WHAT IS CLAIMED IS:

1. A frame construction method in which a layer 1 frame, which is capable of accommodating data of any protocol that is selected from an STM (Synchronous Transfer Mode) signal, ATM (Asynchronous Transfer Mode) cells, a primary IP (Internet Protocol) packet and a best effort IP packet in a common frame format, is constructed to be transferred.

2. A frame construction method as claimed in claim 1, wherein the layer 1 frame includes:

a layer 1 frame header for containing header information of predetermined types; and

a layer 1 frame payload for containing the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc.

3. A frame construction method as claimed in claim 2, wherein the layer 1 frame further includes a payload CRC (Cyclic Redundancy Check) field for containing the result of a CRC operation conducted for the layer 1 frame payload.

4. A frame construction method as claimed in claim 2, wherein the layer 1 frame payload is a variable-length field.

5. A frame construction method as claimed in claim 4, wherein the length of the variable-length layer 1 frame payload is set between 0 Kbyte and 64 Kbytes.

6. A frame construction method as claimed in claim 2, wherein the layer 1 frame header includes:

a "Packet Length" identifier indicating the length of the layer 1

frame payload;

a "Priority" identifier indicating the priority of the data which is transferred in the layer 1 frame;

a "Protocol" identifier indicating the type of the data which is transferred in the layer 1 frame;

a "Frame Mode" identifier indicating the type of the layer 1 frame;

a "Stuff" identifier indicating whether or not stuff data is contained in the layer 1 frame; and

a "Header CRC" identifier indicating the result of a CRC operation conducted for the layer 1 frame header except itself.

7. A frame construction method as claimed in claim 6, wherein the "Protocol" identifier indicates whether the type of the data transferred in the layer 1 frame is IPv4 (Internet Protocol version 4) data, IPv6 (Internet Protocol version 6) data, STM data, ATM data or dummy data.

8. A frame construction method as claimed in claim 6, wherein an OAM (Operating And Management) frame as a special-purpose layer 1 frame for monitoring a path between the ingress point and the egress point is constructed and transferred periodically.

9. A frame construction method as claimed in claim 8, wherein the PN pattern is packed in the payload of the OAM frame.

10. A frame construction method as claimed in claim 8, wherein the "Protocol" identifier indicates whether the type of the data transferred in the layer 1 frame is IPv4 (Internet Protocol version 4) data, IPv6 (Internet Protocol version 6) data, STM data, ATM data, OAM (Operating And Management) data or dummy data.

11. A frame construction method as claimed in claim 6, wherein the "Header CRC" identifier is provided to the layer 1 frame header so as to be used by line terminating devices for establishing byte synchronization and/or frame synchronization.

12. A frame construction method as claimed in claim 2, wherein the layer 1 frame header is a fixed-length field.

13. A frame construction method as claimed in claim 6, wherein in the case where the stuff data is contained in the layer 1 frame, a "Stuffing Length" identifier indicating the length of the stuff data is added to the layer 1 frame header.

14. A frame construction method as claimed in claim 2, wherein a layer 2 frame for containing and transferring the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc. is packed in the layer 1 frame payload.

15. A frame construction method as claimed in claim 14, wherein the layer 2 frame includes:

a layer 2 frame header for containing information to be used for the routing of the layer 2 frame; and

a layer 2 frame payload in which the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc. is packed.

16. A frame construction method as claimed in claim 15, wherein in the case where the STM signal is packed in the layer 2 frame payload, an N channel STM signal of a bit rate of N $\times$ 64 Kbps (8 bits / 125 μsec for each channel) which is transferred from an STM device is packed in

the layer 2 frame payload.

17. A frame construction method as claimed in claim 15, wherein in the case where the ATM cells are packed in the layer 2 frame payload, ATM cells which are transferred from an ATM device are packed in the layer 2 frame payload.

18. A frame construction method as claimed in claim 6, wherein in the case where the STM signal is packed in the layer 1 frame payload, information indicating CBR (Constant Bit Rate) traffic is described in the "Priority" identifier, and information indicating STM is described in the "Protocol" identifier.

19. A frame construction method as claimed in claim 15, wherein in the case where the STM signal is packed in the layer 2 frame payload, the layer 2 frame header includes a route label as information which is used for the routing of the layer 1 frame containing the STM signal through relaying nodes.

20. A frame construction method as claimed in claim 6, wherein in the case where the ATM cells are packed in the layer 1 frame payload, information indicating the type of the ATM cells is described in the "Priority" identifier, and information indicating ATM is described in the "Protocol" identifier.

21. A frame construction method as claimed in claim 15, wherein in the case where the ATM cells are packed in the layer 2 frame payload, the layer 2 frame header includes a route label as information which is used for the routing of the layer 1 frame containing the STM signal through relaying nodes.

22. A frame construction method as claimed in claim 15, wherein in the case where the primary IP packet is packed in the layer 2 frame payload, the primary IP packet is packed in the layer 2 frame payload without being partitioned.

23. A frame construction method as claimed in claim 6, wherein in the case where the primary IP packet is packed in the layer 1 frame payload, information indicating the type of the IP packet is described in the "Priority" identifier, and information indicating IP is described in the "Protocol" identifier.

24. A frame construction method as claimed in claim 15, wherein in the case where the primary IP packet is packed in the layer 2 frame payload, the layer 2 frame header includes:

a route label as information which is used for the routing of the layer 1 frame containing the primary IP packet through relaying nodes; and

a flow label as information which is used for designating a wavelength to be used for transferring the layer 1 frame containing the primary IP packet between relaying nodes.

25. A frame construction method as claimed in claim 24, wherein the flow label is generated by conducting the Hash operation to the header of the primary IP packet.

26. A frame construction method as claimed in claim 15, wherein in the case where the best effort IP packet is packed in the layer 2 frame payload, a best effort IP transfer space length L, which means the length of a transfer space which can be used for the transfer of the layer 1 frame containing the best effort IP packet, is determined as:

$$L = CL - SL - AL - PL - BL$$

where:

CL denotes a predetermined length CL corresponding to a predetermined cycle,

SL denotes the length of a layer 1 frame containing an STM signal that is transferred in the cycle,

AL denotes the lengths of one or more layer 1 frames containing ATM cells that are transferred in the cycle,

PL denotes the length of one or more layer 1 frames containing primary IP packets that are transferred in the cycle, and

BL denotes the length of one or more layer 1 frames containing best effort IP packets that are transferred in the cycle before the transfer of the layer 1 frame containing the best effort IP packet.

27. A frame construction method as claimed in claim 26, wherein if the length B of the layer 1 frame containing the best effort IP packet is equal to the best effort IP transfer space length L, the layer 1 frame containing the best effort IP packet is transmitted as a single frame without being partitioned.

28. A frame construction method as claimed in claim 26, wherein if the length B of the layer 1 frame containing the best effort IP packet is longer than the best effort IP transfer space length L, a BOM (Beginning Of Message) frame of the length L is constructed by use of the front part of the layer 1 frame containing the best effort IP packet, the BOM frame is transmitted, and an EOM (End Of Message) frame including the remaining segment of the layer 1 frame containing the best effort IP packet is stored.

29. A frame construction method as claimed in claim 28, wherein

if the length M of the stored EOM frame is longer than the best effort IP transfer space length L, a COM (Continuation Of Message) frame of the length L is constructed by use of the front part of the stored EOM frame, the COM frame is transmitted, and an EOM frame including the remaining segment of the stored EOM frame is stored.

30. A frame construction method as claimed in claim 28, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is shorter than the best effort IP transfer space length L, the stored EOM frame is transmitted as an EOM frame and the best effort IP transfer space length L is updated into L - M.

31. A frame construction method as claimed in claim 28, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is equal to the best effort IP transfer space length L, the stored EOM frame is transmitted as an EOM frame and thereafter a minimal dummy frame is transmitted.

32. A frame construction method as claimed in claim 28, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is longer than the best effort IP transfer space length L, stuff data is inserted into the payload of the stored EOM frame so as to increase the EOM frame length M into L and the stored EOM frame containing the stuff data is transmitted as an EOM frame.

33. A frame construction method as claimed in claim 26, wherein if there is no best effort IP layer 1 frame to be transferred, a dummy frame of the length L is generated and transmitted.

34. A frame construction method as claimed in claim 26, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is equal to the best effort IP transfer space length L, the best effort IP layer 1 frame is transmitted as a single frame without being partitioned and thereafter a minimal dummy frame is transmitted.

35. A frame construction method as claimed in claim 26, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is longer the best effort IP transfer space length L, stuff data of is inserted into the payload of the best effort IP layer 1 frame so as to increase the best effort IP layer 1 frame length B into L and the best effort IP layer 1 frame including the stuff data is transmitted as a single frame.

36. A frame construction method as claimed in claim 26, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is shorter the best effort IP transfer space length L, the best effort IP layer 1 frame is transmitted as a single frame without being partitioned and the best effort IP transfer space length L is updated into L - B.

37. A frame construction method as claimed in claim 15, wherein in the case where the best effort IP packet is packed in the layer 2 frame payload, the layer 2 frame header includes:

a route label as information which is used for the routing of the layer 1 frame containing the best effort IP packet through relaying nodes; and

a flow label as information which is used for designating a wavelength to be used for transferring the layer 1 frame containing the best effort IP packet between relaying nodes.

38. A frame construction method as claimed in claim 37, wherein the flow label is generated by conducting the Hash operation to the header of the best effort IP packet.

39. A frame construction method as claimed in claim 15, wherein the layer 2 frame header is omitted when the layer 1 frame is transmitted as a COM (Continuation Of Message) frame or an EOM (End Of Message) frame.

40. A frame construction method as claimed in claim 6, wherein in the case where the best effort IP packet is packed in the layer 1 frame payload, information indicating the type of the IP packet is described in the "Priority" identifier, and information indicating IP is described in the "Protocol" identifier.

41. A frame construction device of network equipment comprising a layer 1 frame construction means for constructing a layer 1 frame which is capable of accommodating data of any protocol that is selected from an STM (Synchronous Transfer Mode) signal, ATM (Asynchronous Transfer Mode) cells, a primary IP (Internet Protocol)

packet and a best effort IP packet in a common frame format.

42. A frame construction device as claimed in claim 41, wherein the layer 1 frame constructed by the layer 1 frame construction means includes:

a layer 1 frame header for containing header information of predetermined types; and

a layer 1 frame payload for containing the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc.

43. A frame construction device as claimed in claim 42, wherein the layer 1 frame constructed by the layer 1 frame construction means further includes a payload CRC (Cyclic Redundancy Check) field for containing the result of a CRC operation conducted for the layer 1 frame payload.

44. A frame construction device as claimed in claim 42, wherein the layer 1 frame payload is a variable-length field.

45. A frame construction device as claimed in claim 44, wherein the length of the variable-length layer 1 frame payload is set between 0 Kbyte and 64 Kbytes.

46. A frame construction device as claimed in claim 42, wherein the layer 1 frame header includes:

a "Packet Length" identifier indicating the length of the layer 1 frame payload;

a "Priority" identifier indicating the priority of the data which is transferred in the layer 1 frame;

a "Protocol" identifier indicating the type of the data which is transferred in the layer 1 frame;

a "Frame Mode" identifier indicating the type of the layer 1 frame;

a "Stuff" identifier indicating whether or not stuff data is contained in the layer 1 frame; and

a "Header CRC" identifier indicating the result of a CRC operation conducted for the layer 1 frame header except itself.

47. A frame construction device as claimed in claim 46, wherein the "Protocol" identifier indicates whether the type of the data transferred in the layer 1 frame is IPv4 (Internet Protocol version 4) data, IPv6 (Internet Protocol version 6) data, STM data, ATM data or dummy data.

48. A frame construction device as claimed in claim 46, wherein an OAM (Operating And Management) frame as a special-purpose layer 1 frame for monitoring a path between the ingress point and the egress point is constructed and transferred periodically.

49. A frame construction device as claimed in claim 48, wherein the PN pattern is packed in the payload of the OAM frame.

50. A frame construction device as claimed in claim 48, wherein the "Protocol" identifier indicates whether the type of the data transferred in the layer 1 frame is IPv4 (Internet Protocol version 4) data, IPv6 (Internet Protocol version 6) data, STM data, ATM data, OAM (Operating And Management) data or dummy data.

51. A frame construction device as claimed in claim 46, wherein the "Header CRC" identifier is provided to the layer 1 frame header so as

to be used by line terminating devices for establishing byte synchronization and/or frame synchronization.

52. A frame construction device as claimed in claim 42, wherein the layer 1 frame header is a fixed-length field.

53. A frame construction device as claimed in claim 46, wherein in the case where the stuff data is contained in the layer 1 frame, the layer 1 frame construction means adds a "Stuffing Length" identifier indicating the length of the stuff data to the layer 1 frame header.

54. A frame construction device as claimed in claim 42, wherein a layer 2 frame for containing and transferring the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc. is packed by the layer 1 frame construction means in the layer 1 frame payload.

55. A frame construction device as claimed in claim 54, wherein the layer 2 frame includes:

a layer 2 frame header for containing information to be used for the routing of the layer 2 frame; and

a layer 2 frame payload in which the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc. is packed.

56. A frame construction device as claimed in claim 55, wherein in the case where the STM signal is packed in the layer 2 frame payload, an N channel STM signal of a bit rate of N $\times$ 64 Kbps (8 bits / 125 μsec for each channel) which is transferred from an STM device is packed in the layer 2 frame payload.

57. A frame construction device as claimed in claim 55, wherein in the case where the ATM cells are packed in the layer 2 frame payload, ATM cells which are transferred from an ATM device are packed in the layer 2 frame payload.

58. A frame construction device as claimed in claim 46, wherein in the case where the STM signal is packed in the layer 1 frame payload, information indicating CBR (Constant Bit Rate) traffic is described in the "Priority" identifier, and information indicating STM is described in the "Protocol" identifier.

59. A frame construction device as claimed in claim 55, wherein in the case where the STM signal is packed in the layer 2 frame payload, the layer 2 frame header includes a route label as information which is used for the routing of the layer 1 frame containing the STM signal through relaying nodes.

60. A frame construction device as claimed in claim 46, wherein in the case where the ATM cells are packed in the layer 1 frame payload, information indicating the type of the ATM cells is described in the "Priority" identifier, and information indicating ATM is described in the "Protocol" identifier.

61. A frame construction device as claimed in claim 55, wherein in the case where the ATM cells are packed in the layer 2 frame payload, the layer 2 frame header includes a route label as information which is used for the routing of the layer 1 frame containing the STM signal through relaying nodes.

62. A frame construction device as claimed in claim 55, wherein

in the case where the primary IP packet is packed in the layer 2 frame payload, the primary IP packet is packed in the layer 2 frame payload without being partitioned.

63. A frame construction device as claimed in claim 46, wherein in the case where the primary IP packet is packed in the layer 1 frame payload, information indicating the type of the IP packet is described in the "Priority" identifier, and information indicating IP is described in the "Protocol" identifier.

64. A frame construction device as claimed in claim 55, wherein in the case where the primary IP packet is packed in the layer 2 frame payload, the layer 2 frame header includes:

a route label as information which is used for the routing of the layer 1 frame containing the primary IP packet through relaying nodes; and

a flow label as information which is used for designating a wavelength to be used for transferring the layer 1 frame containing the primary IP packet between relaying nodes.

65. A frame construction device as claimed in claim 64, wherein the flow label is generated by conducting the Hash operation to the header of the primary IP packet.

66. A frame construction device as claimed in claim 55, wherein in the case where the best effort IP packet is packed in the layer 2 frame payload, a best effort IP transfer space length L, which means the length of a transfer space which can be used for the transfer of the layer 1 frame containing the best effort IP packet, is determined as:

$$L = CL - SL - AL - PL - BL$$

where:

CL denotes a predetermined length CL corresponding to a predetermined cycle,

SL denotes the length of a layer 1 frame containing an STM signal that is transferred in the cycle,

AL denotes the lengths of one or more layer 1 frames containing ATM cells that are transferred in the cycle,

PL denotes the length of one or more layer 1 frames containing primary IP packets that are transferred in the cycle, and

BL denotes the length of one or more layer 1 frames containing best effort IP packets that are transferred in the cycle before the transfer of the layer 1 frame containing the best effort IP packet.

67. A frame construction device as claimed in claim 66, wherein if the length B of the layer 1 frame containing the best effort IP packet is equal to the best effort IP transfer space length L, the layer 1 frame containing the best effort IP packet is transmitted as a single frame without being partitioned.

68. A frame construction device as claimed in claim 66, wherein if the length B of the layer 1 frame containing the best effort IP packet is longer than the best effort IP transfer space length L, a BOM (Beginning Of Message) frame of the length L is constructed by use of the front part of the layer 1 frame containing the best effort IP packet, the BOM frame is transmitted, and an EOM (End Of Message) frame including the remaining segment of the layer 1 frame containing the best effort IP packet is stored.

69. A frame construction device as claimed in claim 68, wherein if the length M of the stored EOM frame is longer than the best effort IP

transfer space length L, a COM (Continuation Of Message) frame of the length L is constructed by use of the front part of the stored EOM frame, the COM frame is transmitted, and an EOM frame including the remaining segment of the stored EOM frame is stored.

70. A frame construction device as claimed in claim 68, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is shorter than the best effort IP transfer space length L, the stored EOM frame is transmitted as an EOM frame and the best effort IP transfer space length L is updated into L - M.

71. A frame construction device as claimed in claim 68, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is equal to the best effort IP transfer space length L, the stored EOM frame is transmitted as an EOM frame and thereafter a minimal dummy frame is transmitted.

72. A frame construction device as claimed in claim 68, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is longer than the best effort IP transfer space length L, stuff data is inserted into the payload of the stored EOM frame so as to increase the EOM frame length M into L and the stored EOM frame containing the stuff data is transmitted as an EOM frame.

73. A frame construction device as claimed in claim 66, wherein

if there is no best effort IP layer 1 frame to be transferred, a dummy frame of the length L is generated and transmitted.

74. A frame construction device as claimed in claim 66, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is equal to the best effort IP transfer space length L, the best effort IP layer 1 frame is transmitted as a single frame without being partitioned and thereafter a minimal dummy frame is transmitted.

75. A frame construction device as claimed in claim 66, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is longer the best effort IP transfer space length L, stuff data of is inserted into the payload of the best effort IP layer 1 frame so as to increase the best effort IP layer 1 frame length B into L and the best effort IP layer 1 frame including the stuff data is transmitted as a single frame.

76. A frame construction device as claimed in claim 66, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is shorter the best effort IP transfer space length L, the best effort IP layer 1 frame is transmitted as a single frame without being partitioned and the best effort IP transfer space length L is updated into L - B.

77. A frame construction device as claimed in claim 55, wherein in the case where the best effort IP packet is packed in the layer 2 frame payload, the layer 2 frame header includes:

a route label as information which is used for the routing of the layer 1 frame containing the best effort IP packet through relaying nodes; and

a flow label as information which is used for designating a wavelength to be used for transferring the layer 1 frame containing the best effort IP packet between relaying nodes.

78. A frame construction device as claimed in claim 77, wherein the flow label is generated by conducting the Hash operation to the header of the best effort IP packet.

79. A frame construction device as claimed in claim 55, wherein the layer 2 frame header is omitted when the layer 1 frame is transmitted as a COM (Continuation Of Message) frame or an EOM (End Of Message) frame.

80. A frame construction device as claimed in claim 46, wherein in the case where the best effort IP packet is packed in the layer 1 frame payload, information indicating the type of the IP packet is described in the "Priority" identifier, and information indicating IP is described in the "Protocol" identifier.

81. A data transfer system including edge nodes and core nodes, wherein:

the edge node is connected to an STM (Synchronous Transfer Mode) device, an ATM (Asynchronous Transfer Mode) device and/or an IP (Internet Protocol) router and includes:

a layer 1 frame construction means for constructing a layer 1 frame which is capable of accommodating data of any protocol that is selected from an STM signal supplied from the STM device, ATM cells supplied from the ATM device, a primary IP packet supplied from the IP router, and a best effort IP packet supplied from the IP router in a common frame format;

a layer 1 frame transmission means for transmitting the layer 1 frames containing the STM signals, the layer 1 frames containing the ATM cells, the layer 1 frames containing the primary IP packets and/or the layer 1 frames containing the best effort IP packets which are constructed by the layer 1 frame construction means to a core node;

a layer 1 frame separation means for separating layer 1 frames supplied from the core node into STM layer 1 frames containing STM signals, ATM layer 1 frames containing ATM cells, primary IP layer 1 frames containing primary IP packets, and best effort IP layer 1 frames containing best effort IP packets;

a data extraction means for extracting the STM signals, the ATM cells, the primary IP packets and the best effort IP packets from the STM layer 1 frames, the ATM layer 1 frames, the primary IP layer 1 frames and the best effort IP layer 1 frames, respectively; and

a data transmission means for transmitting the STM signals extracted by the data extraction means to the STM device, transmitting the ATM cells extracted by the data extraction means to the ATM device, and transmitting the primary IP packets and the best effort IP packets extracted by the data extraction means to the IP router, and

the core node is connected to one or more edge nodes and/or one or more core nodes and transfers the layer 1 frame supplied from an edge node or core node to an appropriate core node or edge node by referring to routing information contained in the layer 1 frame.

82. A data transfer system as claimed in claim 81, wherein the layer 1 frame constructed by the layer 1 frame construction means includes:

a layer 1 frame header for containing header information of predetermined types; and

a layer 1 frame payload for containing the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc.

83. A data transfer system as claimed in claim 82, wherein the layer 1 frame constructed by the layer 1 frame construction means further includes a payload CRC (Cyclic Redundancy Check) field for containing the result of a CRC operation conducted for the layer 1 frame payload.

84. A data transfer system as claimed in claim 82, wherein the layer 1 frame payload is a variable-length field.

85. A data transfer system as claimed in claim 84, wherein the length of the variable-length layer 1 frame payload is set between 0 Kbyte and 64 Kbytes.

86. A data transfer system as claimed in claim 82, wherein the layer 1 frame header includes:

a "Packet Length" identifier indicating the length of the layer 1 frame payload;

a "Priority" identifier indicating the priority of the data which is transferred in the layer 1 frame;

a "Protocol" identifier indicating the type of the data which is transferred in the layer 1 frame;

a "Frame Mode" identifier indicating the type of the layer 1 frame;

a "Stuff" identifier indicating whether or not stuff data is contained in the layer 1 frame; and

a "Header CRC" identifier indicating the result of a CRC operation conducted for the layer 1 frame header except itself.

87. A data transfer system as claimed in claim 86, wherein the "Protocol" identifier indicates whether the type of the data transferred in the layer 1 frame is IPv4 (Internet Protocol version 4) data, IPv6 (Internet Protocol version 6) data, STM data, ATM data or dummy data.

88. A data transfer system as claimed in claim 86, wherein an OAM (Operating And Management) frame as a special-purpose layer 1 frame for monitoring a path between the ingress point and the egress point is constructed and transferred periodically.

89. A data transfer system as claimed in claim 88, wherein the PN pattern is packed in the payload of the OAM frame.

90. A data transfer system as claimed in claim 88, wherein the "Protocol" identifier indicates whether the type of the data transferred in the layer 1 frame is IPv4 (Internet Protocol version 4) data, IPv6 (Internet Protocol version 6) data, STM data, ATM data, OAM (Operating And Management) data or dummy data.

91. A data transfer system as claimed in claim 86, wherein the "Header CRC" identifier is provided to the layer 1 frame header so as to be used by line terminating devices for establishing byte synchronization and/or frame synchronization.

92. A data transfer system as claimed in claim 82, wherein the layer 1 frame header is a fixed-length field.

93. A data transfer system as claimed in claim 86, wherein in the case where the stuff data is contained in the layer 1 frame, the layer 1 frame construction means adds a "Stuffing Length" identifier indicating the length of the stuff data to the layer 1 frame header.

94. A data transfer system as claimed in claim 82, wherein a layer 2 frame for containing and transferring the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc. is packed by the layer 1 frame construction means in the layer 1 frame payload.

95. A data transfer system as claimed in claim 94, wherein the layer 2 frame includes:

a layer 2 frame header for containing information to be used for the routing of the layer 2 frame; and

a layer 2 frame payload in which the data such as the STM signal, the ATM cells, the primary IP packet, the best effort IP packet, etc. is packed.

96. A data transfer system as claimed in claim 95, wherein in the case where the STM signal is packed in the layer 2 frame payload, an N channel STM signal of a bit rate of N $\times$ 64 Kbps (8 bits / 125 μsec for each channel) which is transferred from the STM device is packed in the layer 2 frame payload.

97. A data transfer system as claimed in claim 95, wherein in the case where the ATM cells are packed in the layer 2 frame payload, ATM

cells which are transferred from the ATM device are packed in the layer 2 frame payload.

98. A data transfer system as claimed in claim 86, wherein in the case where the STM signal is packed in the layer 1 frame payload, information indicating CBR (Constant Bit Rate) traffic is described in the "Priority" identifier, and information indicating STM is described in the "Protocol" identifier.

99. A data transfer system as claimed in claim 95, wherein in the case where the STM signal is packed in the layer 2 frame payload, the layer 2 frame header includes a route label as information which is used for the routing of the layer 1 frame containing the STM signal through relaying nodes.

100. A data transfer system as claimed in claim 86, wherein in the case where the ATM cells are packed in the layer 1 frame payload, information indicating the type of the ATM cells is described in the "Priority" identifier, and information indicating ATM is described in the "Protocol" identifier.

101. A data transfer system as claimed in claim 95, wherein in the case where the ATM cells are packed in the layer 2 frame payload, the layer 2 frame header includes a route label as information which is used for the routing of the layer 1 frame containing the STM signal through relaying nodes.

102. A data transfer system as claimed in claim 95, wherein in the case where the primary IP packet is packed in the layer 2 frame payload, the primary IP packet is packed in the layer 2 frame payload

without being partitioned.

103. A data transfer system as claimed in claim 86, wherein in the case where the primary IP packet is packed in the layer 1 frame payload, information indicating the type of the IP packet is described in the "Priority" identifier, and information indicating IP is described in the "Protocol" identifier.

104. A data transfer system as claimed in claim 95, wherein in the case where the primary IP packet is packed in the layer 2 frame payload, the layer 2 frame header includes:

a route label as information which is used for the routing of the layer 1 frame containing the primary IP packet through relaying nodes; and

a flow label as information which is used for designating a wavelength to be used for transferring the layer 1 frame containing the primary IP packet between relaying nodes.

105. A data transfer system as claimed in claim 104, wherein the flow label is generated by conducting the Hash operation to the header of the primary IP packet.

106. A data transfer system as claimed in claim 95, wherein in the case where the best effort IP packet is packed in the layer 2 frame payload, a best effort IP transfer space length L, which means the length of a transfer space which can be used for the transfer of the layer 1 frame containing the best effort IP packet, is determined as:

$$L = CL - SL - AL - PL - BL$$

where:

CL denotes a predetermined length CL corresponding to a

predetermined cycle,

SL denotes the length of a layer 1 frame containing an STM signal that is transferred in the cycle,

AL denotes the lengths of one or more layer 1 frames containing ATM cells that are transferred in the cycle,

PL denotes the length of one or more layer 1 frames containing primary IP packets that are transferred in the cycle, and

BL denotes the length of one or more layer 1 frames containing best effort IP packets that are transferred in the cycle before the transfer of the layer 1 frame containing the best effort IP packet.

107. A data transfer system as claimed in claim 106, wherein if the length B of the layer 1 frame containing the best effort IP packet is equal to the best effort IP transfer space length L, the layer 1 frame containing the best effort IP packet is transmitted as a single frame without being partitioned.

108. A data transfer system as claimed in claim 106, wherein if the length B of the layer 1 frame containing the best effort IP packet is longer than the best effort IP transfer space length L, a BOM (Beginning Of Message) frame of the length L is constructed by use of the front part of the layer 1 frame containing the best effort IP packet, the BOM frame is transmitted, and an EOM (End Of Message) frame including the remaining segment of the layer 1 frame containing the best effort IP packet is stored.

109. A data transfer system as claimed in claim 108, wherein if the length M of the stored EOM frame is longer than the best effort IP transfer space length L, a COM (Continuation Of Message) frame of the length L is constructed by use of the front part of the stored EOM frame,

the COM frame is transmitted, and an EOM frame including the remaining segment of the stored EOM frame is stored.

110. A data transfer system as claimed in claim 108, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is shorter than the best effort IP transfer space length L, the stored EOM frame is transmitted as an EOM frame and the best effort IP transfer space length L is updated into L - M.

111. A data transfer system as claimed in claim 108, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is equal to the best effort IP transfer space length L, the stored EOM frame is transmitted as an EOM frame and thereafter a minimal dummy frame is transmitted.

112. A data transfer system as claimed in claim 108, wherein if the length M of the stored EOM frame is shorter than the best effort IP transfer space length L and if the EOM frame length M and a minimal dummy frame length D added together (M + D) is longer than the best effort IP transfer space length L, stuff data is inserted into the payload of the stored EOM frame so as to increase the EOM frame length M into L and the stored EOM frame containing the stuff data is transmitted as an EOM frame.

113. A data transfer system as claimed in claim 106, wherein if there is no best effort IP layer 1 frame to be transferred, a dummy frame of the length L is generated and transmitted.

114. A data transfer system as claimed in claim 106, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is equal to the best effort IP transfer space length L, the best effort IP layer 1 frame is transmitted as a single frame without being partitioned and thereafter a minimal dummy frame is transmitted.

115. A data transfer system as claimed in claim 106, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is longer the best effort IP transfer space length L, stuff data of is inserted into the payload of the best effort IP layer 1 frame so as to increase the best effort IP layer 1 frame length B into L and the best effort IP layer 1 frame including the stuff data is transmitted as a single frame.

116. A data transfer system as claimed in claim 106, wherein if the length B of the layer 1 frame containing the best effort IP packet is shorter than the best effort IP transfer space length L and if the best effort IP layer 1 frame length B and a minimal dummy frame length D added together (B + D) is shorter the best effort IP transfer space length L, the best effort IP layer 1 frame is transmitted as a single frame without being partitioned and the best effort IP transfer space length L is updated into L - B.

117. A data transfer system as claimed in claim 95, wherein in the case where the best effort IP packet is packed in the layer 2 frame payload, the layer 2 frame header includes:

a route label as information which is used for the routing of the layer 1 frame containing the best effort IP packet through relaying nodes; and

a flow label as information which is used for designating a wavelength to be used for transferring the layer 1 frame containing the best effort IP packet between relaying nodes.

118. A data transfer system as claimed in claim 117, wherein the flow label is generated by conducting the Hash operation to the header of the best effort IP packet.

119. A data transfer system as claimed in claim 95, wherein the layer 2 frame header is omitted when the layer 1 frame is transmitted as a COM (Continuation Of Message) frame or an EOM (End Of Message) frame.

120. A data transfer system as claimed in claim 86, wherein in the case where the best effort IP packet is packed in the layer 1 frame payload, information indicating the type of the IP packet is described in the "Priority" identifier, and information indicating IP is described in the "Protocol" identifier.

121. A data transfer system as claimed in claim 81, wherein the layer 1 frame transmission means of the edge node transmits the layer 1 frames containing the STM signals to the core node at predetermined time intervals.

122. A data transfer system as claimed in claim 121, wherein the predetermined time interval is set at 125 μ sec.

123. A data transfer system as claimed in claim 81, wherein the layer 1 frame transmission means of the edge node frame multiplexes the layer 1 frames containing the STM signals, the layer 1 frames containing the ATM cells, the layer 1 frames containing the primary IP packets and the layer 1 frames containing the best effort IP packets giving high priority in order of STM, ATM, primary IP and best effort IP, and transmits the frame-multiplexed layer 1 frames to the core node.

124. A data transfer system as claimed in claim 83, wherein the layer 1 frame construction means of the edge node conducts 16-bit CRC (Cyclic Redundancy Check) operation to the layer 1 frame payload and adds the CRC16 result to the layer 1 frame as the payload CRC field.

125. A data transfer system as claimed in claim 83, wherein the layer 1 frame construction means of the edge node conducts 32-bit CRC (Cyclic Redundancy Check) operation to the layer 1 frame payload and adds the CRC16 result to the layer 1 frame as the payload CRC field.

126. A data transfer system as claimed in claim 82, wherein the layer 1 frame separation means of the edge node establishes frame synchronization by use of the layer 1 frame headers of the layer 1 frames transferred from the core node.

127. A data transfer system as claimed in claim 86, wherein the layer 1 frame separation means of the edge node judges whether the data contained in the layer 1 frame is the STM signal, the ATM cells or the IP packet by referring to the "Protocol" identifier of the layer 1 frame header, and demultiplexes frame-multiplexed layer 1 frames into layer 1 frames by use of the "Packet Length" identifier of the layer 1 frame header.

128. A data transfer system as claimed in claim 95, wherein the core node extracts the layer 2 frames from received layer 1 frames,

determines the next core node or edge node to which the data contained in the layer 2 frame payload should be transferred, by referring to the layer 2 frame header of each layer 2 frame,

constructs the layer 1 frames containing the data with regard to each next node,

frame multiplexes the layer 1 frames with regard to each next node, and

transmits the frame-multiplexed layer 1 frames to the next core node or edge node.

129. A data transfer system as claimed in claim 128, wherein the core node transmits the layer 1 frames containing the STM signals to the next node at predetermined time intervals.

130. A data transfer system as claimed in claim 129, wherein the predetermined time interval is set at 125 μsec.

131. A data transfer system as claimed in claim 128, wherein the core node frame multiplexes the layer 1 frames containing the STM signals, the layer 1 frames containing the ATM cells, the layer 1 frames containing the primary IP packets and the layer 1 frames containing the best effort IP packets giving high priority in order of STM, ATM, primary IP and best effort IP, and transmits the frame-multiplexed layer 1 frames to the next core node or edge node.

132. A data transfer system as claimed in claim 88, wherein the OAM frame is used by the edge node at the egress point for path monitoring.